Accessories

INTRODUCTION

From the user's point of view the electricity service in a building consists of socket outlets, light switches, power points, clock connectors, cooker control units and similar outlets. Such fittings are collectively known as accessories.

SOCKET OUTLETS

A socket outlet is the correct name of what is popularly known as a power point. It is a female socket connected to the power wiring in the building and will accept the male plug attached at the end of the flexible wire of an appliance such as a vacuum cleaner, electric fire or music centre.They are rated at 2 A, 5 A.13A and 15A, the spacing of the pins and sockets being different for the different ratings. This makes sure that a plug of one rating cannot be inserted, even wilfully, into a socket of a different rating. Plugs and sockets rated at 2 and 5 A are available in both two- and three-pin versions, but those of 15 A rating are made only with three pins.

Types of Domestic plugs and sockets

- Type A (North America/Japanese 2-pin)

- Type B (American 3-pin)

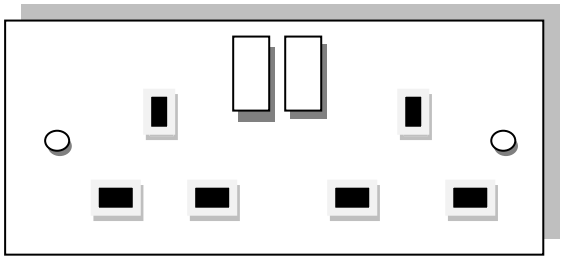
- Type C (European 2-pin)

- (Type D – German 2-pin)

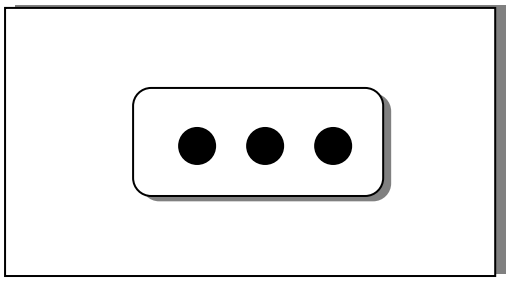
- Type E (French 2-pin , female earth)

- Type F (British 3- pin)

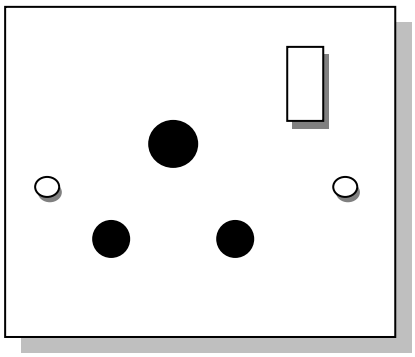
- Duplex British 3 – pin (type –F)



- Type G (Danish 3-pin)



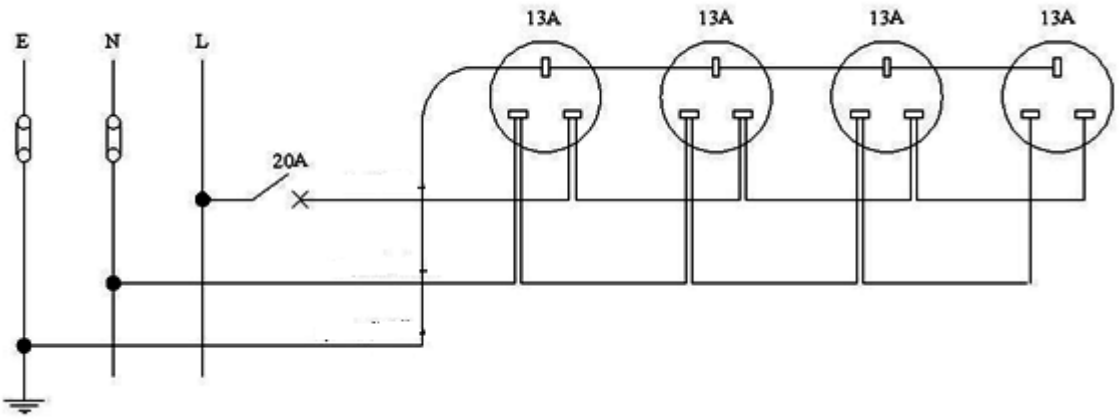
- BS 546 (15 A/250 V earthed)



Type of connection of socket outlets circuits

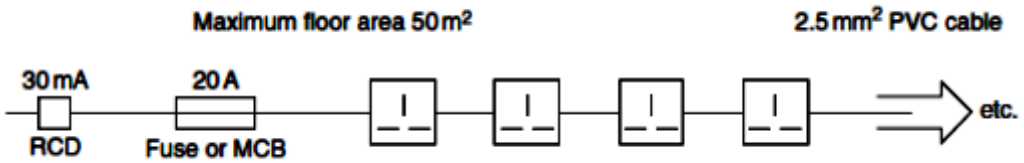
1. Radial circuit

- In radial circuit we can connect 4-6, 13A socket outlets protected by 20A -25A mcb.



Radial circuit

It is required to connect 30mA RCD (residual current device) for each circuit as shown in Figure below:



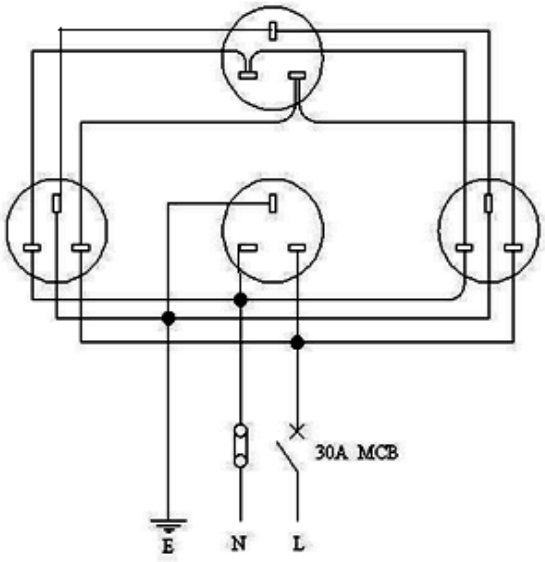
Radial circuit with RCD

2. Ring circuit

Ring circuit is used to increase reliability of the system and to reduce the number of circuits and circuit breakers in the final distribution board and also to serve larger area with socket outlets.

A ring circuit with 30A protective device can serve

Area 90 – 100 m^2 , i.e., connecting about 16 sixteen ,13A socket outlet with 2.5 mm2 PVC cable.



Ring connected socket outlets

- Ring circuits fed from systems where no earth terminal is provided by the Electricity Supply Company (TT systems) must be protected by an RCD rated at 30 mA, In all installations, a socket intended to feed equipment outdoors must be individually protected by a 30 mA RCD.
- Where a socket is mounted on a vertical wall, its height above the floor level orthe working surface level level must be such that mechanical damage is unlikely. A minimum mounting height of 150 mm is recommended.

The fused plug

- In many situations there is a need for socket outlets to be closely spaced so that they are available to feed appliances and equipment without the need to use long and dangerous leads. For example, the domestic kitchen worktop should be provided with sockets to feed the many appliances (deep fat fryer, kettle, sandwich toaster, carving knife, toaster, microwave oven, coffee maker, and so on) which are likely to be used. Similarly, in the living room we need to supply television sets, video recorders, stereo players, table lamps, room heaters, etc. In this case, more outlets will he needed to allow for occasional rearrangement of furniture, which may well obstruct access to some outlets.
- Thus a ring circuit protected by a 30 A or 32 A device may well feed twenty socket outlets. It follows that judgment must be used

to make as certain as possible that the total loading will not exceed the protective device rating, or its failure and inconvenience will result. Two basic steps will normally ensure that a ring circuit is not overloaded.

- **1.** Do not feed heavy and steady loads (the domestic immersion heater is the most obvious example) from the ring circuit, but make special provision for them on separate circuits.
- **2.**-Make sure that the ring circuit does not feed too great an area. This is usually ensured by limiting a single ring circuit to sockets within an area not greater than one hundred square meters.

A fused plug and socket to BS 1363 is shown in Fig.1 below.

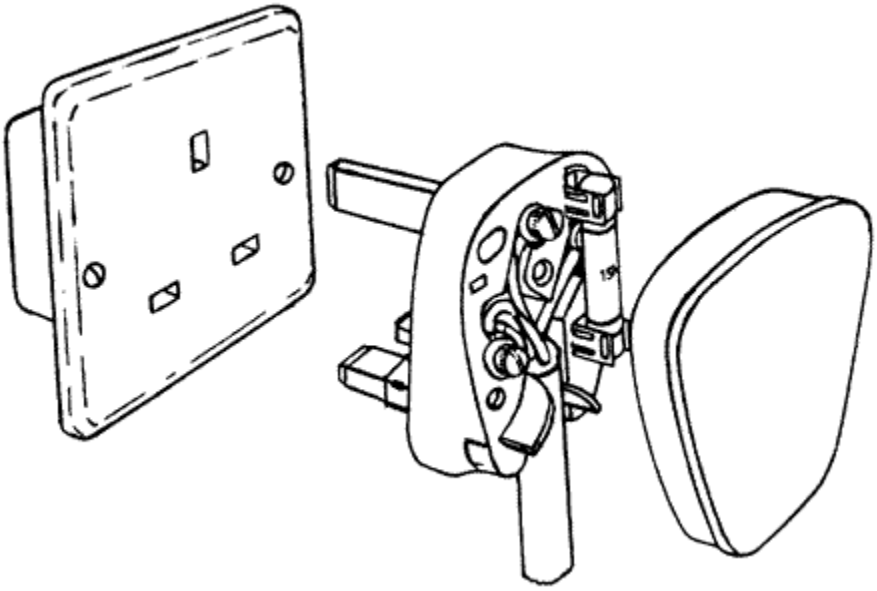


Fig.1 Plug and socket to BS 1363

A plug to BS 1363 without a fuse is not available. The circuit protection in the distribution board or consumer's unit covers the circuit wiring, whilst the fuse in the plug protects the appliance and its cord as shown in Fig .2. In this way, each appliance can be protected by a suitable fuse, for example, a 3 A fuse for a table lamp or a 13 A fuse for a 3 kW fan heater.

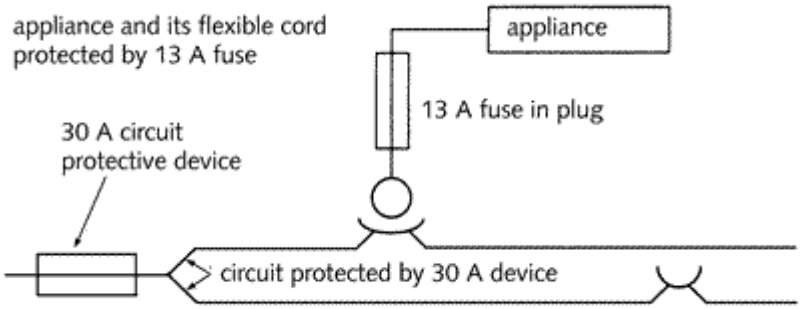


Fig .2 Principle of appliance protection by plug fuse.

- **15A and 16A socket outlets are each considered as one power point which must be protected by one separate circuit breaker (usually 30A rating) . No diversity factor is taken.**

2. Industrial (heavy duty) socket outlets

There is no reason at all to prevent the installation of BS 1363 (13 A) socket outlets in industrial situations. Indeed, where light industry, such as electronics manufacture, is concerned, these sockets are most suitable. However, heavy duty industrial socket outlets are available, either in single-phase or 3-phase. These are shown in Fig.3 below.

Fig.3 Industrial (heavy duty) socket outlets

VOLTAGE DROP IN RING CIRCUITS

Sometimes it is necessary to calculate the voltage drop occurring in a ring circuit. The method to use is illustrated by Example 1 if the loads taken from the points of utilisation and the cable lengths between those points are known.

Example 1

Figure 4 (a) shows a single-phase ring circuit wired in 2.5 mm^2 core (with cpc) 70ºC pvc-insulated and sheathed cable. The figure gives the loads taken from each point of utilisation.

The first stage is to determine the current distribution and as shown in Figure 4(b) a current given by I_x A is taken to flow in the first section, (I_x - 5)A in the second section, and so on.

If the resistance per metre of the phase conductor is denoted by 'r' then:

$$I_x 6r + (I_x - 5)4r + (I_x - 15)3r + (I_x - 20)6r + (I_x - 25)8r + (I_x - 30)4r = 0$$

I_x r (6 + 4 +3 + 6 + 8 + 4) – r (20 + 45 + 120 + 200 + 120) = 0

I_x =16.29A

The current distribution therefore is as shown in Figure 4(c) and it is now possible to calculate the voltage drop.

This is given by:

[(16:29 x 6) + (11:29 x 4)

+ (1:29 x 3)] x $\frac{\text{mV/A/m}}{1000}$ V

i.e.

$$\frac{146.8 \times \text{mV/A/m}}{1000} \text{ V}$$

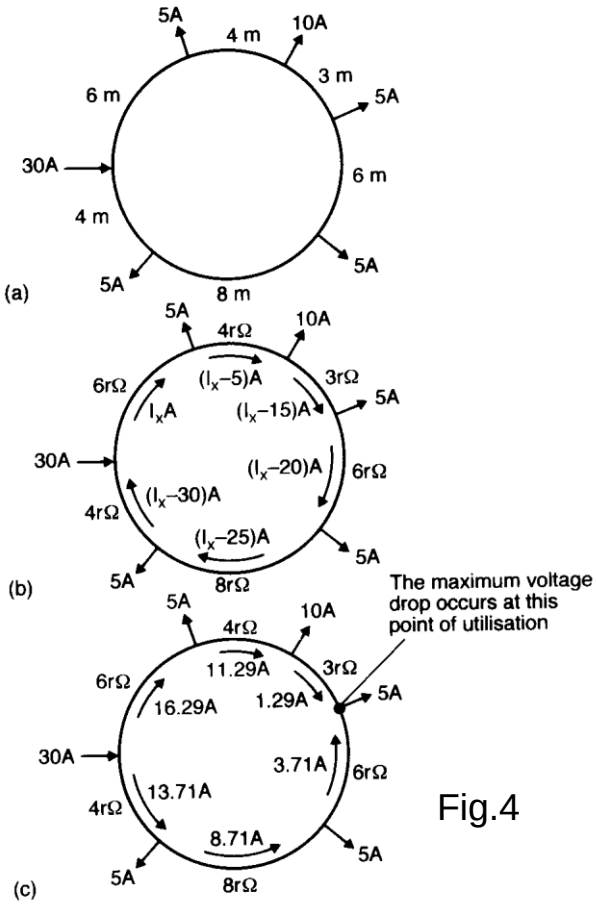


Fig.4

From Table (3-23) Column 3 the mV/A/m value is found to be

15.38 milliohms /A / m.
The voltage drop is therefore $\frac{146.8 \times 15.38}{1000} = 2.25\ V$

SWITCHES

A switch is used to make or interrupt a circuit. There are two types of switches:
1. Dolly operated switch.
2. Rocker operated switch.

The older type of switch mechanism was dolly operated. It is illustrated in Fig. 5. The moving contact was on a spring lever which was moved by a cam. Dolly operated switches have now been entirely superseded by rocker operated switches. This type is also illustrated in Fig. 5.
The advantages of the rocker switch are that it is easier to operate and that it is almost impossible to hold it half open, even deliberately.
Ratings:
Most manufacturers make switches in two standard capacities, the lower being rated at 5 amps and the higher at 10, 15 or 20 amps.

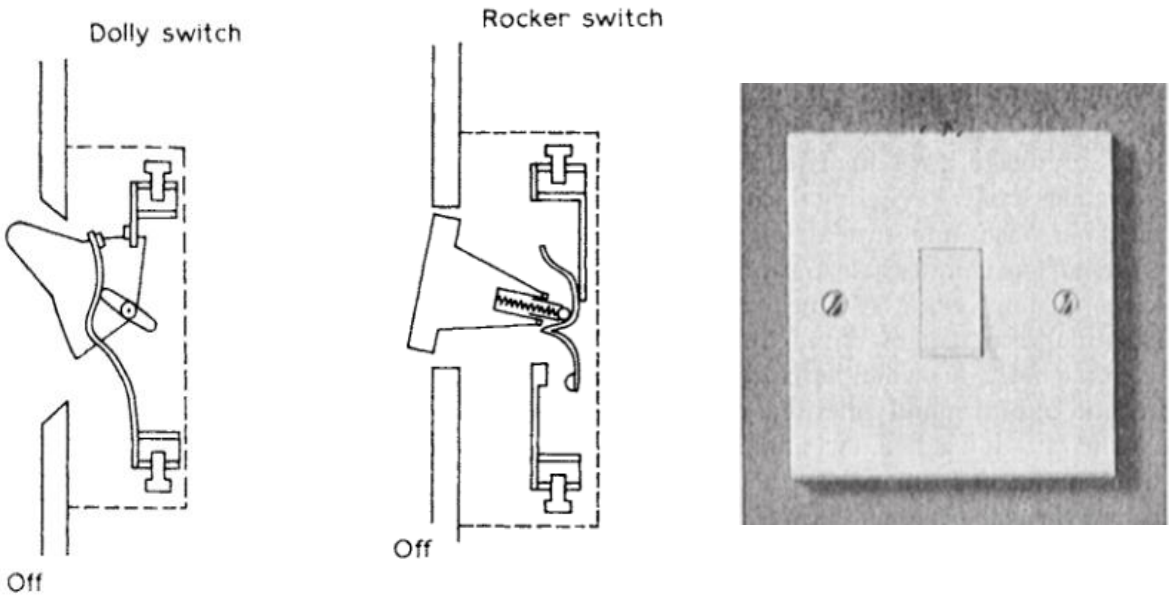


Fig.5

Boxes

The box is fixed to the wall, and the wires going to the switch are drawn into the box. After this the wires are connected to the mechanism. To carry out this operation the electrician must pull the wires away from the wall sufficiently to give himself room to work on the back of the mechanism. He then pushes the mechanism back into the box and the length of wire which he had to pull out from the wall becomes slack inside the box. It is therefore important that the box is large enough to accommodate a certain amount of slack wire at the back of the mechanism.

Standard boxes for recessing within a wall are 35 mm deep. There are also shallow boxes available which are 25 mm deep. These boxes are shown in Figure 6.

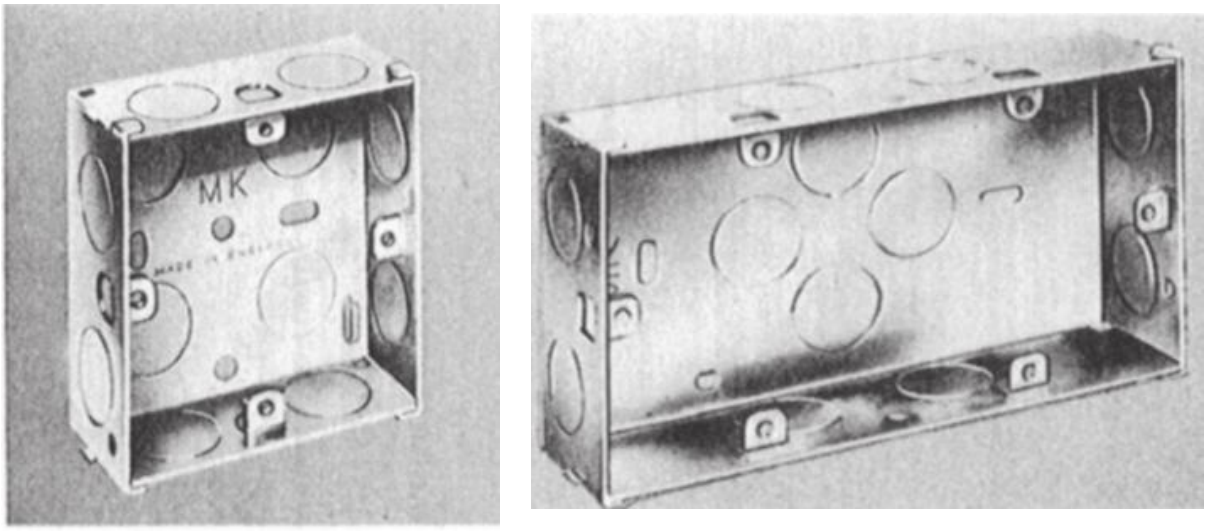


Fig.6